

Shorelands at Risk

Building an Inventory of Vulnerable Estuary Shoreland Resources

Proposal for NOAA Coastal Management Fellow, 2015 – 2017

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Introduction

Oregon's dramatic and beautiful coast line is the result of dynamic, powerful natural forces of weather, climate, ocean waves and currents, and the Earth's own tectonic evolution. These forces continually shape the coast, creating an environment that is at once attractive and dangerous. The vulnerability of coastal communities to chronic and catastrophic forces as well as climate change is a concern to those who live, work, and recreate in those communities and to public officials responsible for community safety and well-being. Oregon's statewide land use planning program requires local governments to plan for and make decisions that account for hazards known to be present in this active, dynamic environment.

An effective frame for understanding the idea of risk in this environment is that risk represents the intersection of a hazard and some vulnerability. Virtually all planning support tools for addressing climate change or coastal hazards characterize a hazard, some aspect of vulnerability, or both. For example, a community may want to take a look at the effects of rising sea levels. A line on a map that represents likely future high tides would be useful to show areas subject to sea-level rise inundation hazards. However, that line alone, which shows areas at risk, is inadequate for robust community-scale planning for future sea levels. A robust planning effort relies on information about people, resources, infrastructure, and other assets located within areas at risk in order to further planning for future conditions.

Identification of assets in areas at risk is the foundation for a local vulnerability inventory.

We propose a fellowship where the selected fellow will focus on the intersection of these issues. The fellow will work closely with Oregon Coastal Management Program (OCMP) staff in the Department of Land Conservation and Development (DLCD). DLCD administers Oregon's land use planning program, in partnership with local government planning departments. Specifically, the fellow will focus much needed attention on low-lying estuary shoreland areas that are subject to risk from sea level rise, and will be responsible for assembling a vulnerability inventory that will fill significant gaps in the knowledgebase of OCMP partners working on sea level rise adaptation planning and related coastal resilience issues. Through this work, the fellow will gain experience in developing geospatial data products and in incorporating these products into natural resource management policy with practical real-world applications.

This project will develop a preliminary vulnerability inventory for Oregon coastal shorelands subject to inundation from sea level rise. Shoreland planning inventories are typically conducted to provide information necessary for identifying coastal shorelands and designating uses and management policies within identified areas. This coastal shorelands vulnerability inventory will include data on coastal infrastructure (public facilities, roads, water lines, sewer lines), property improvements, natural resource areas, and relevant population metrics. It will identify and quantify, where possible, people, infrastructure, natural resources, and other community assets that are in areas at risk from sea level rise. The results of the inventory may be summarized in a simple relative vulnerability index. The process of assembling the vulnerability inventory and summary index will also identify areas where existing data is insufficient for shoreland planning purposes, and will help to identify areas where investment in additional data collection is necessary.

Background

In 2010 the state of Oregon released the "Oregon Climate Change Adaptation Framework" (Oregon Adaptation Framework Work Group, 2010.), which identifies authorities, actions, research, and resources needed to increase Oregon's capacity to address the likely effects of climate change. The framework lays out eleven expected climate-related risks, the basic adaptive capacity to deal with those risks, short-term priority actions, and an eventual long-term process to improve Oregon's capacity to adapt to variable and changing climate conditions. The framework specifies that it will also be necessary to continue to develop adaptation strategies and plans, in particular at the regional and local level. It is at this local level that an inventory of vulnerable assets is of great importance to planners working on strategies for adapting to rising sea levels.

Within this adaptation framework context, sea level rise, and the increased coastal erosion and risk of inundation from increasing sea levels and increasing wave heights and storm surges is identified as an expected climate risk for Oregon. What follows is a summary of the issues and actions identified by the framework, and to which the fellow would be making an active contribution.

Timing and geography

Sea level rose globally through the 20th century and is expected to continue to rise in small increments through the 21st century. Along the Oregon coast, the amount of apparent sea-level rise will vary considerably because of local tectonic processes of land subsidence and uplift. On the central coast, sea level rise has out-paced vertical land movement. However, in southern and northern Oregon, upward vertical land movement has been greater than that of sea level rise. By 2050, global sea level is projected to rise about 28cm +/- 3.2cm (estimated range 17.6-48.2cm); by 2100, projected increase is about 82.7cm +/- 10.6 cm (NRC, 2012).

Ecosystems

Higher sea levels and more powerful storms will alter coastal shorelines, shorelands, and estuaries.

Increased wave heights, storm surges, and sea levels can lead to loss of natural buffering functions of beaches, tidal wetlands, and dunes. Accelerating shoreline erosion has been documented, and is resulting in increased applications for shore protective structures. Shoreline alterations typically reduce the ability of beaches, tidal wetlands, and dunes to adjust to new conditions. Under a combination of high tide, storm surge and high waves, coastal spits can be breached or overtapped, which in turn will dramatically change estuarine circulation and productivity. Estuarine shorelines will likely shift with changes in sea level, but the nature, rate and magnitude of such changes in Oregon's estuaries are not well understood. Tidal wetlands, including some wetland restoration and mitigation sites, may be lost because they aren't able to migrate inland due to hardened shorelines and bulkheads. Estuarine intertidal areas may be lost if sediment inputs are insufficient to maintain equilibrium with increased tide levels. Intertidal communities and habitats will shift in response to changes in the frequency of inundation, salinity, and water depth, all of which can be affected by erosion and changes in sea level.



Yaquina Bay Estuary

Built and developed systems

Increasing sea levels, wave heights and storm surges will increase coastal erosion and likely increase damage to private property and infrastructure situated on coastal shorelands. Coastal erosion and the common response to reduce shoreland erosion can lead to long-term loss of natural buffering functions of beaches, tidal wetlands, and dunes. Applications for shoreline alteration permits to protect property and infrastructure are increasing, but in the long term they reduce the ability of shore systems to adjust to new conditions. Coastal erosion can affect transportation infrastructure and thus restrict mobility, access, and delivery of essential services. Some of Oregon's largest and most popular coastal parks are at risk from shoreline erosion. By mid-century, more areas are likely to become regularly inundated by high tides or storm surges.

Economy

Property and infrastructure at risk of damage due to coastal erosion and inundation will eventually need to be protected, repaired, rebuilt, or relocated.

Public health and safety

Higher sea levels could eventually result in saltwater intrusion into coastal aquifers used to supply domestic and agriculture uses. Higher waves and storm surges can increase risk of injury and death to residents and visitors of shoreland properties.

Project Description

Adaptation planning in Oregon would benefit from improved spatial data about areas of greatest relative vulnerability to higher ocean water levels. The results of this project will help Oregon coastal communities reduce uncertainties related to shoreland impacts from climate related hazards such as sea level rise, increased storm intensity and wave heights.

Current Situation

Oregon coastal shorelands are lands contiguous with the ocean, estuaries, and coastal lakes as defined in Statewide Planning Goal 17. Local governments are required to do shoreland planning as part of Goal 17, one of 19 statewide land use planning goals. Such planning involves delineation of a Coastal Shoreland Planning Area that includes areas subject to geologic and hydrologic hazards. The purpose of Goal 17 is "to conserve, protect, develop, and, where appropriate, restore the resources and benefits of all coastal shorelands." In addition to its conservation objectives for protecting various shoreland habitats, Goal 17 aims to reduce hazard to human life and property. This element of Goal 17 complements and reinforces Statewide Planning Goal 7 for Areas Subject to Natural Hazards, which directs local governments to plan for areas subject to natural hazards.

- While local governments are required to plan for shoreland related natural hazards as part of Goal 17, sea level rise is generally not incorporated as a risk that is planned for in the Goal 17 context due to lack of relevant local data
- There is no consistent coast-wide sea level rise risk area for local governments to use in planning and adaptation activities.
- There is no Goal 17 database for assets within coastal shoreland planning areas and no related GIS inventories are “adopted” at the local level, or regularly used in decision making.
- There has been no focused effort to inventory vulnerable infrastructure or populations, within coastal shoreland planning areas.

Expected Improvements

- The fellow will work with the OCMP GIS coordinator to compile a coast-wide estuary sea level rise planning area in GIS format.
- Within this geography, the fellow will conduct a survey of people and priority assets, to compile a vulnerability inventory of those assets in GIS format.
- Produce summary of information on vulnerabilities within the sea level rise planning area, and assemble resulting informational products for use by local governments and other program partners involved in hazard and adaptation planning.

Desired Outcome

The fellow will prepare an analysis based on the state of the knowledge that exists at the end of the fellowship term. The fellow will produce an informative summary of the primary issues that will help state and local government partners re-think the impacts of sea level rise in light of known challenges.

- State and local partners will be operating from up to date and accurate information, landowners will be more aware of their risk and exposure
- The state will have a starting point for a discussion for new long term policy-making regarding sea level rise adaptation, armoring, non-structural alternatives, and retreat
- This information will contribute to future discussions about adaptation strategies

Strategic Focus Areas

Resilient Coastal Communities:

This project will emphasize the *Resilient Coastal Communities* strategic focus area.

Resilience is a challenging condition to discuss, since it is difficult to measure or quantify.

Resilience results from the effects of, and interactions among, different conditions and capacities in a community. In planning and management circles, resilience is too seldom linked to specific conditions. This project is based on the premise that reducing community *vulnerability* will inherently improve its resilience. The idea is that reducing vulnerability will reduce risks to the community, which in turn will raise the basic level of community resilience.

The core purpose of this project is to compile

data on community vulnerability in order to support state and local efforts to better understand and address climate-related ocean hazards. Reducing community vulnerability is a fundamental strategic approach to improving community resilience.

The vulnerability inventory that results from this project will be the first generally-available resource with specific information on community vulnerability that will support community planning for natural hazards. In Oregon, such planning potentially occurs both under Oregon's Statewide Planning Goal 7 – *Areas Subject to Natural Hazards*, and within FEMA's framework for developing local Natural Hazard Mitigation Plans.

By compiling data and information about infrastructure and other improvements that are located in areas at risk of ocean inundation, and by making those data resources available to state and local planners, resource managers, and decision makers, this project and the fellow will directly foster “user-driven ... assessment efforts ... to enhance understanding of ... economic impacts of coastal hazards and climate change.” The information made available as a result of this project will also fundamentally change the way planners, elected officials and decision-makers are able to talk about local climate risks. It will allow them to *quantify*, in economic terms, potential losses from climate-related hazard events of different magnitudes. This specific capacity to quantify risks associated with climate change has considerable potential to increase public understanding of the potential burdens to the community associated with climate change.

This fellowship will foster resilient coastal communities by building capacity to adapt to and mitigate local climate-related risks by reducing community vulnerabilities. The fellow will develop an integrated resource for coastal network partners and residents that includes data, information, training, technical assistance, and policy tools. The crux of the fellow’s effort will be to compile data and information about infrastructure and improvements in areas subject to ocean inundation. Organizing this vulnerability data for online access will involve the creation of useable information from the inventory. Since much of this information will be made generally available for the first time as a result of the project, it will also be necessary to develop documentation and technical assistance materials to foster its legitimate use. The fellow will compile and make available a suite of policy tools and strategies that coastal communities have used to improve resilience by reducing community vulnerabilities. Finally, throughout the project, the fellow will continuously engage with the OCMP’s local planning partners to support the use of the inventory in developing local strategies to reduce climate risks.



Hatfield Marine Science Center, Newport, OR

Goals and Objectives

Goal: Improve the common operating picture framework for Oregon sea level rise planners at all scales, by comprehensively filling high priority data gaps in estuary shoreland sea level rise areas.

Objective: To deliver specific priority GIS products to the various fellowship project partners including local governments. These products may include, but are not limited to, data on:

- **Natural Environment:** coastal and marine ecosystems
- **Economy:** marine businesses and tourism
- **Infrastructure:** ports, energy, telecommunications, water systems (drinking, sewer, wastewater)
- **Built Environment:** buildings, improvements, land use (residential, commercial, industrial), zoning

Objective: To ensure that local governments, state agencies, landowners, and others are aware of inventory results and planning implications. The fellow will:

- Conduct community-centric analyses to create easy to interpret information products for partners
- Present results in a number of local planner and related forums

Milestones and Outcomes

Task 1: Oregon Coastal Management and Sea Level Rise status Review (Sept 2015-Oct, 2015)

This task will introduce the fellow to the OCMP planning program, and the information and data that agencies and local governments use to support shoreland planning and management decisions. The fellow will work with the OCMP mentors to create a detailed fellowship work program and timeline. This time period also includes time for meeting key program and local contacts, and the assembling of a project coordination team and schedule.

- Outcomes: Inventory of background information for climate related decision making; network of program contacts; familiarity with Oregon planning topics; detailed work program and schedule.

Task 2: Initial Inventory Scoping and Compilation of existing data (Oct. 2015 -Mar, 2016)

The fellow will prepare an overall plan for the compilation of the vulnerability inventory, identify processes for assembling data to be contained in the inventory, and review available data and scoping of planner needs. The GIS coordinator will assist with the generation of the geographic footprint of a coast-wide sea level rise planning area. A project team will be assembled to provide input on the inventory contents to ensure that results will fit seamlessly into existing planning efforts. This task will also be used to verify information gaps and prioritize new data targeted for inclusion.

- Outcomes: Initial inventory outline, inclusion of any existing data where readily available, extended coordination with user community, schedule and processes for remaining data creation / collection.

Task 3: Assemble Vulnerability Inventory (April 2016-Mar. 2017)

Once a plan and inventory schema are in place, the fellow will begin assembly of inventory contents. Field work to confirm and improve the accuracy of existing data and to collect data about new or missing assets will be performed. This information will form the core of a modern living data resource for use by all parties concerned in sea level rise issues.

- Outcomes: an established vulnerability inventory focused on the sea level rise impact area, plan and process for continued maintenance of the inventory.

Task 4: Analysis of Vulnerability Inventory and creation of related products (April 2017 – August 2017)

The fellow will conduct a geospatial analysis that examines the newly collected vulnerability inventory information to generate exposure analyses and related information products for local jurisdiction partners. The products will examine the extent of assets at risk within the sea level rise area, along with an assessment of possible policy implications and potential for mitigation of negative effects. The fellow will present results in a number of local planner and related forums.

- Outcomes: analysis of extent and future impacts of sea level rise, with findings that relate to future planning decisions. Increased awareness of vulnerable assets and adaptation needs.

Fellow Mentoring

Where: The Fellowship project will be housed in the Salem office of the Oregon Coastal Management Program (OCMP), a division of the Oregon Department of Land Conservation and Development.

Who: The Fellow will be mentored by several experienced Coastal staff: Jeff Weber, Coastal Conservation Coordinator at OCMP and lead author of the Oregon Climate Change Adaptation Framework, will provide guidance on Oregon climate change strategies and coordination with related network program staff. Andy Lanier, Natural Resource Specialist and former Coastal Management fellow, will provide technical guidance on GIS data assembly tasks and coordination with the Oregon framework data community. The Fellow will confer periodically with the Coastal Program Manager, participate in staff meetings typically held in the main DLCD offices in Salem, and participate in semi-annual coastal network meetings with local planners.

Value to Fellow: The Fellowship project will provide a broad experience in many spheres that make up climate adaptation and resilience within coastal management. The Fellow will work on a small, focused team where his/her input has a direct impact on how Oregon shorelands are managed, and will meet and work with practitioners at the community level such as city and county planners, and others with local knowledge. In addition, the Fellow will gain hands-on experience with information technologies related to GIS, decision support , and web-based information delivery, and have the opportunity to interact with professionals in the field of hazards management and planning in local, state, and federal agencies, non-governmental organizations, and academia. In short, the fellow will gain:

- Knowledge and experience in local and state coastal management system operations, policy and day-to-day management.
- Opportunities to create working relationships and contacts with coastal resource professionals, managers, resource users, and scientists.
- Skill in combining the best of information technologies such as GIS and web delivery to support practical decision making needs.
- Experience in developing adaptation strategies that will have practiced real-world applications.

Project Partners

A wide number of partner agencies have interests in the planning and management of sea level rise threats and thus will have a strong interest in the outcomes of the Fellowship project. Key partners include:

Department of Land Conservation and Development (DLCD): charged with implementing Statewide Planning Goal 17 (Coastal Shorelands) which includes provisions for management of shoreland resources, and Goal 7 (Natural Hazards), which directs local governments to plan for areas subject to natural hazards.

Department of Geology and Mineral Industries (DOGAMI): conducts research and provides advice on geologic hazards and processes. DOGAMI has completed detailed coastal erosion and hazard maps and analyses for the ocean shores of Clatsop, Tillamook, Lincoln, and portions of Curry and Coos Counties.

State Interagency Hazard Mitigation Team (State IHMT): The State IHMT is comprised of about 18 state agencies involved with natural hazards. The State IHMT meets quarterly to understand losses arising from natural hazards, coordinate recommended strategies to mitigate loss of life, property, and natural resources, and maintain the Oregon Natural Hazard Mitigation Plan.

Climate Change Action Team of the West Coast Governors Alliance on Ocean Health (WCGA): working to create a framework and access to information that helps local governments wisely plan for the shoreline impacts resulting from climate change over the next several decades. This work includes plans to create a west-coast wide web-based map of sea level rise and storm hazards. The data assembled by this fellowship will comprise major elements of the Oregon data for such a tool.

Creation of the products identified in this proposal will enable the above agencies and partners to use a common set of verified information in not only making decisions on specific planning decisions, but also in working comprehensively to develop improved management strategies in the future.

Cost Share Description

The State of Oregon will contribute both in-kind services and a \$15,000 non-federal cash match. The Department of Land Conservation and Development will contribute \$15,000 from its general fund. DLCD will provide in-kind match in the form of work space, equipment, materials and supplies, and access to a state vehicle and support services at the Salem office location.

A furnished computer work station and appropriate software will be provided, along with all necessary office supplies and materials for performing the work. Standard software employed by the OCMP includes Microsoft Office (Word, Excel, Access, and PowerPoint), and ESRI products. The agency is PC-based with each staff member having a desktop computer, as well as access to an equipment pool that includes laptops, printers, scanners, a projector, a digital camera, and a handheld GPS unit. Travel costs to in-state destinations in performance of the work program will be reimbursed by DLCD in accordance with the state travel rules. The work space, supplies and services, and travel support will be provided for the entire two-year period of the Fellowship. Because the CSC Fellow will be part of the DLCD staff he or she will have equal access to all training offered to permanent staff as well as special training identified as needed.

References

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